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Harris et al.

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(54) **MULTI-FREQUENCY REAL-TIME DATA STREAM HANDOFF**

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H04W 36/02 (2009.01)

(52) **U.S. Cl.**
CPC ***H04W 36/02*** (2013.01)

(58) **Field of Classification Search**
CPC H04W 36/023; H04W 36/30; H04W 36/32
USPC 370/328, 331, 412
See application file for complete search history.

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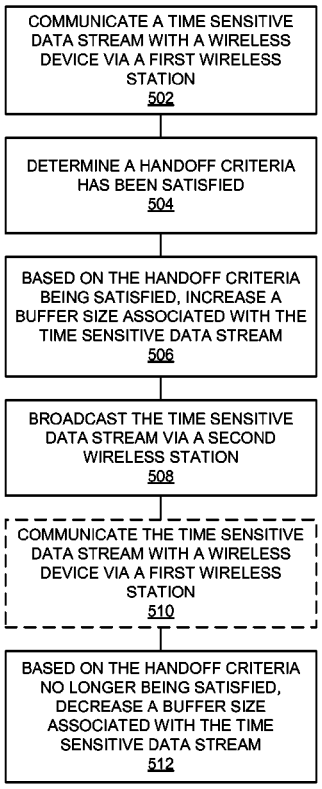
Primary Examiner — Brandon Renner

(57) **ABSTRACT**

A method of operating a communication system is disclosed. A time sensitive data stream is sent to a wireless device via a first wireless station. A handoff criteria is determined to have been satisfied. Based on the handoff criteria being satisfied, at least one control message is sent that instructs the wireless device to increase a buffer size associated with the time sensitive data stream.

12 Claims, 7 Drawing Sheets



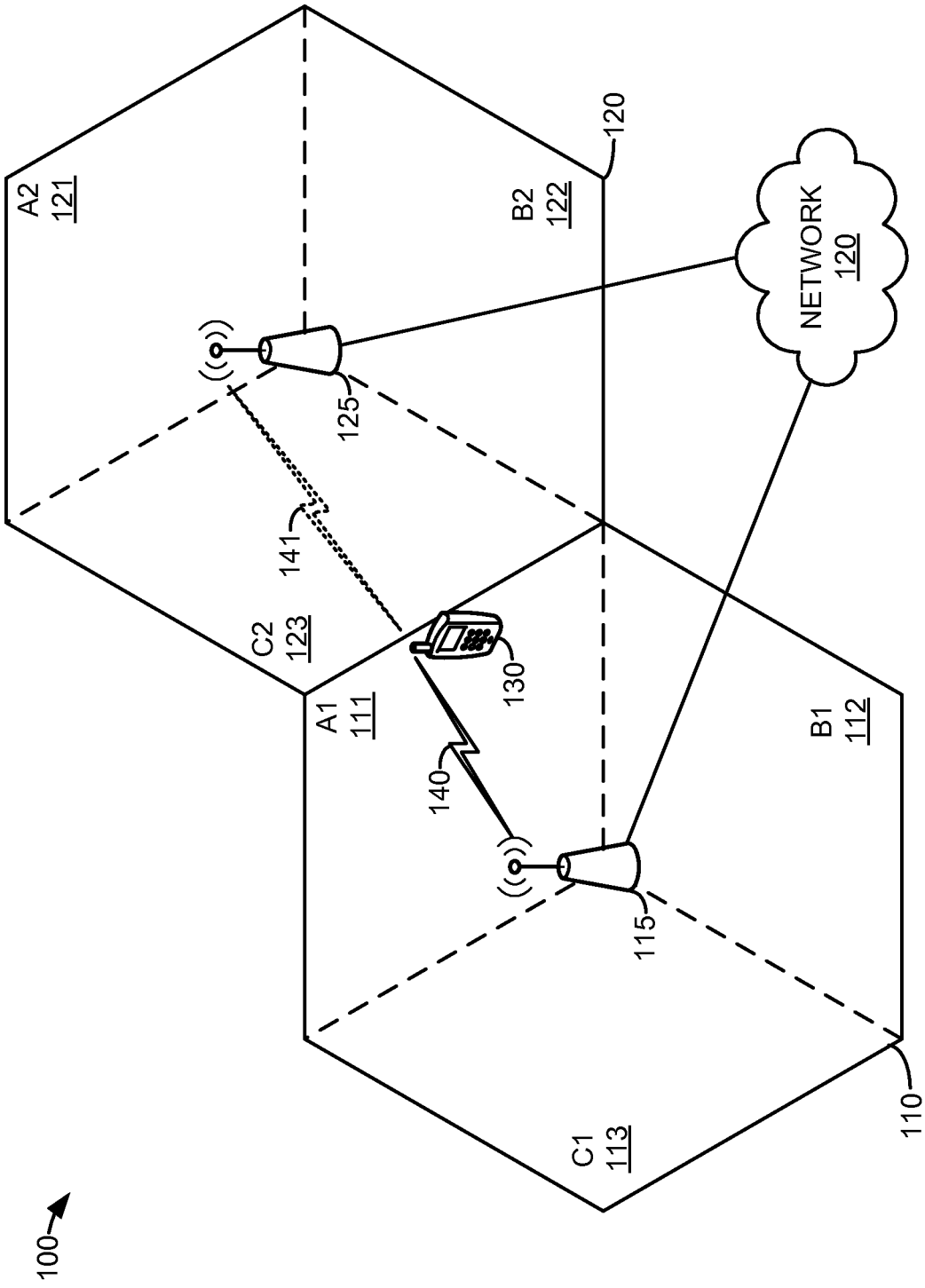

A2
121
B2
122
120
NETWORK
120
125
141
C2
123
130
A1
111
B1
112
140
115
C1
113
110
100

FIGURE 1

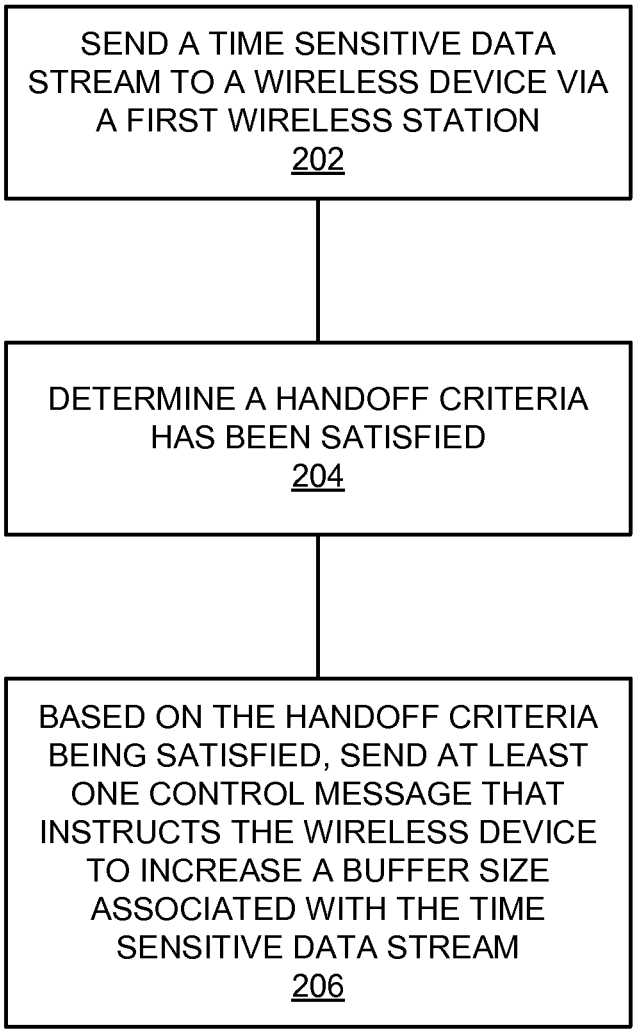

SEND A TIME SENSITIVE DATA STREAM TO A WIRELESS DEVICE VIA A FIRST WIRELESS STATION
202
DETERMINE A HANDOFF CRITERIA HAS BEEN SATISFIED
204
BASED ON THE HANDOFF CRITERIA BEING SATISFIED, SEND AT LEAST ONE CONTROL MESSAGE THAT INSTRUCTS THE WIRELESS DEVICE TO INCREASE A BUFFER SIZE ASSOCIATED WITH THE TIME SENSITIVE DATA STREAM
206

FIGURE 2

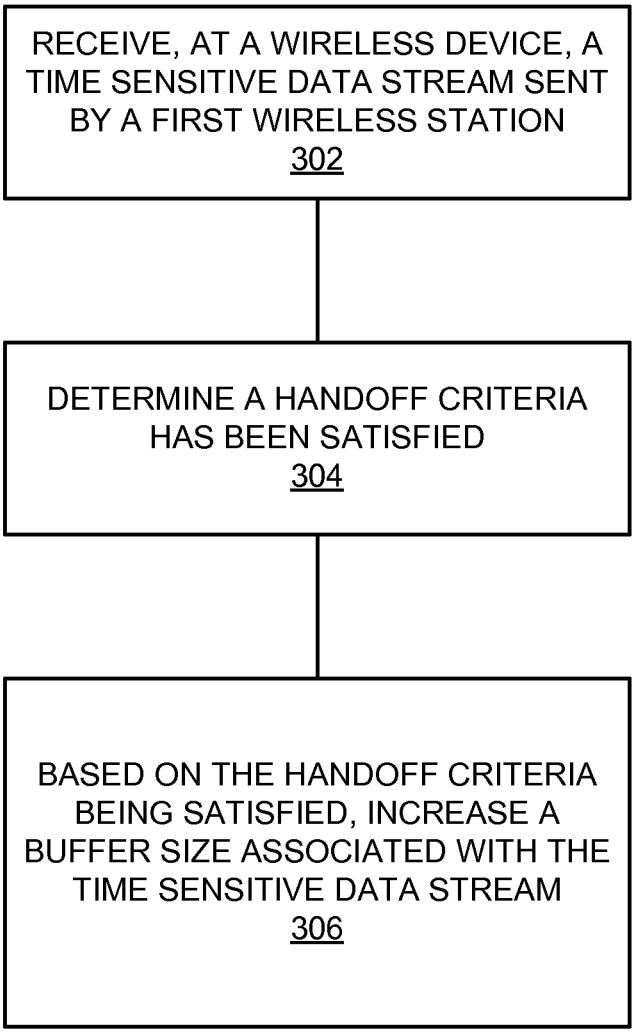

RECEIVE, AT A WIRELESS DEVICE, A TIME SENSITIVE DATA STREAM SENT BY A FIRST WIRELESS STATION
302
DETERMINE A HANDOFF CRITERIA HAS BEEN SATISFIED
304
BASED ON THE HANDOFF CRITERIA BEING SATISFIED, INCREASE A BUFFER SIZE ASSOCIATED WITH THE TIME SENSITIVE DATA STREAM
306

FIGURE 3

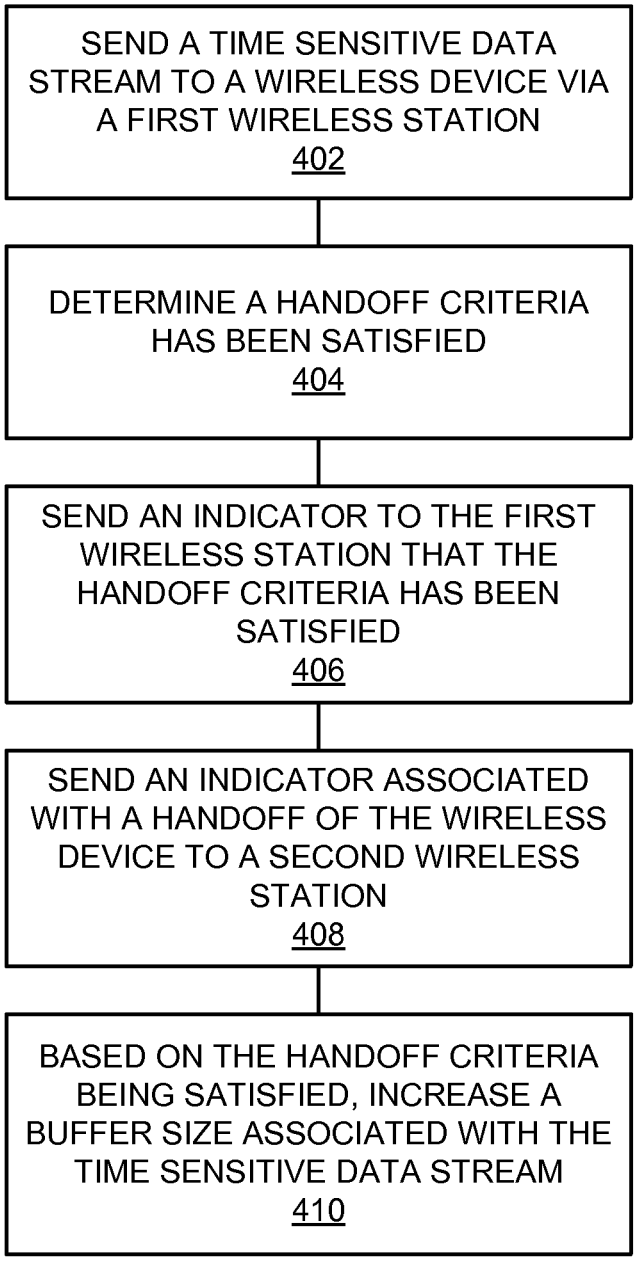

SEND A TIME SENSITIVE DATA STREAM TO A WIRELESS DEVICE VIA A FIRST WIRELESS STATION
402
DETERMINE A HANDOFF CRITERIA HAS BEEN SATISFIED
404
SEND AN INDICATOR TO THE FIRST WIRELESS STATION THAT THE HANDOFF CRITERIA HAS BEEN SATISFIED
406
SEND AN INDICATOR ASSOCIATED WITH A HANDOFF OF THE WIRELESS DEVICE TO A SECOND WIRELESS STATION
408
BASED ON THE HANDOFF CRITERIA BEING SATISFIED, INCREASE A BUFFER SIZE ASSOCIATED WITH THE TIME SENSITIVE DATA STREAM
410

FIGURE 4

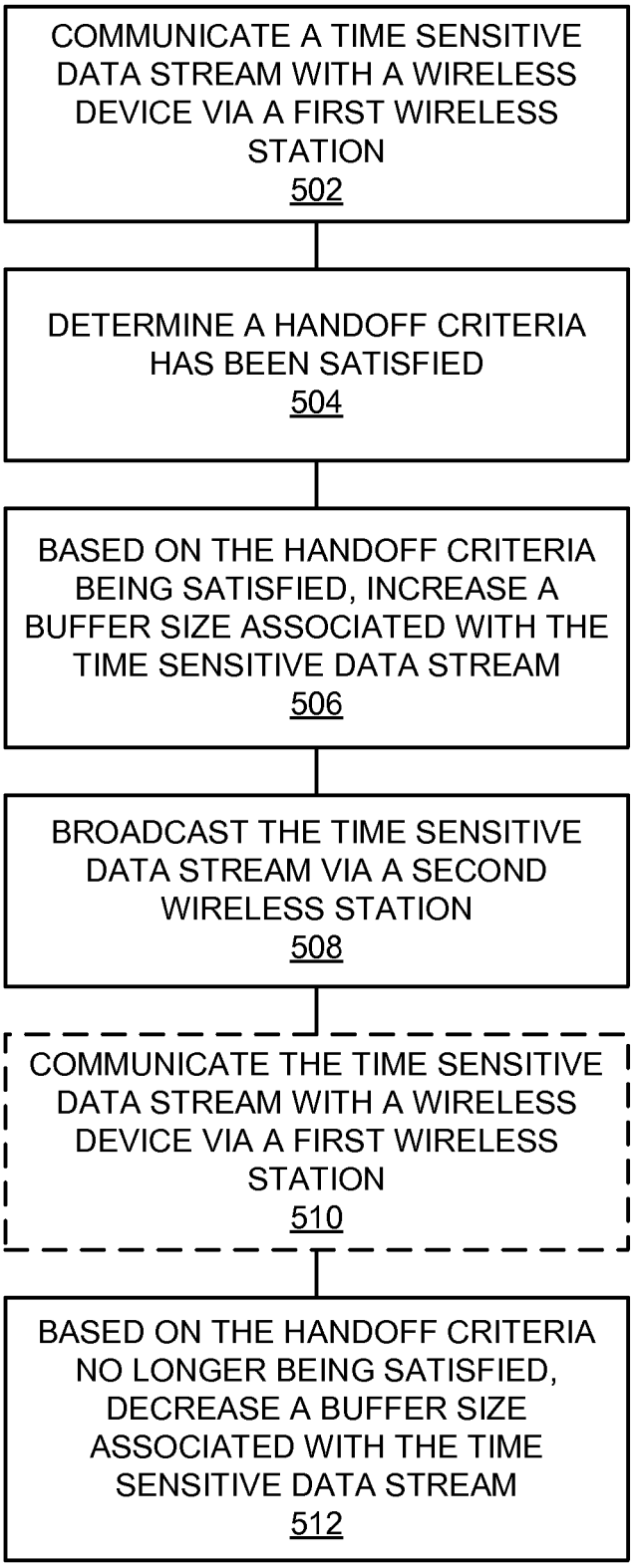

COMMUNICATE A TIME SENSITIVE DATA STREAM WITH A WIRELESS DEVICE VIA A FIRST WIRELESS STATION
502
DETERMINE A HANDOFF CRITERIA HAS BEEN SATISFIED
504
BASED ON THE HANDOFF CRITERIA BEING SATISFIED, INCREASE A BUFFER SIZE ASSOCIATED WITH THE TIME SENSITIVE DATA STREAM
506
BROADCAST THE TIME SENSITIVE DATA STREAM VIA A SECOND WIRELESS STATION
508
COMMUNICATE THE TIME SENSITIVE DATA STREAM WITH A WIRELESS DEVICE VIA A FIRST WIRELESS STATION
510
BASED ON THE HANDOFF CRITERIA NO LONGER BEING SATISFIED, DECREASE A BUFFER SIZE ASSOCIATED WITH THE TIME SENSITIVE DATA STREAM
512

FIGURE 5

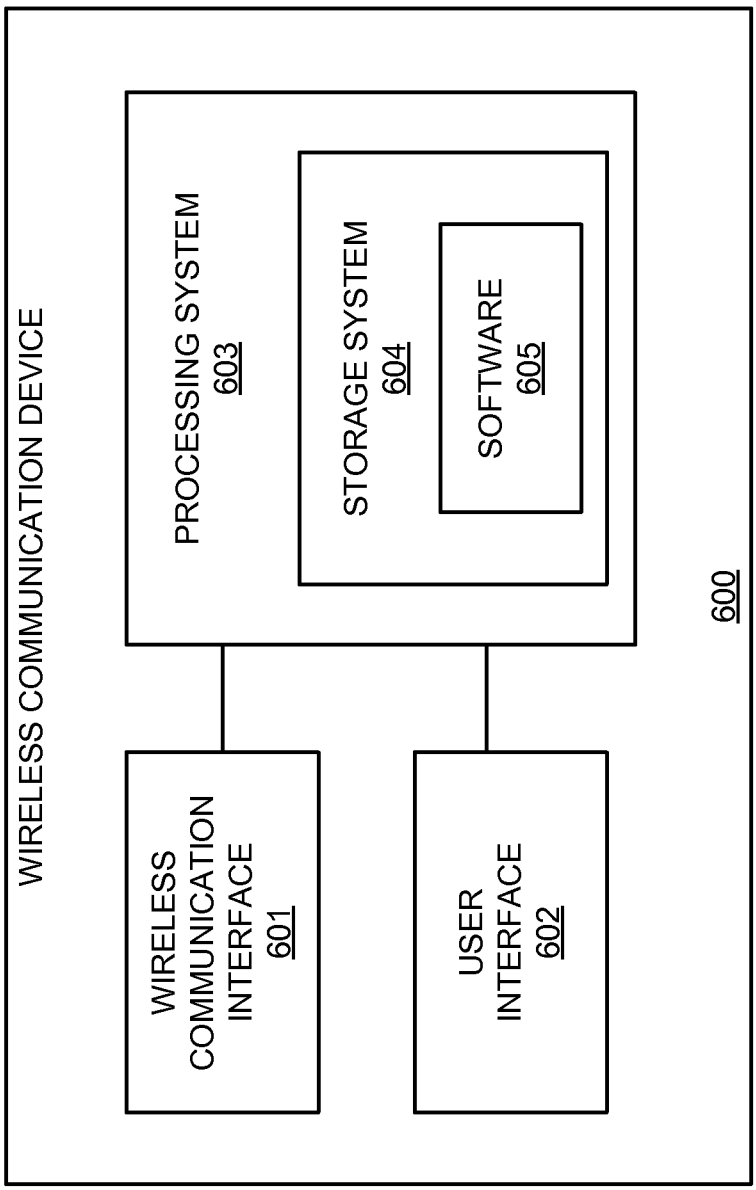

WIRELESS COMMUNICATION DEVICE
PROCESSING SYSTEM
603
STORAGE SYSTEM
604
SOFTWARE
605
WIRELESS COMMUNICATION INTERFACE
601
USER INTERFACE
602
600

FIGURE 6

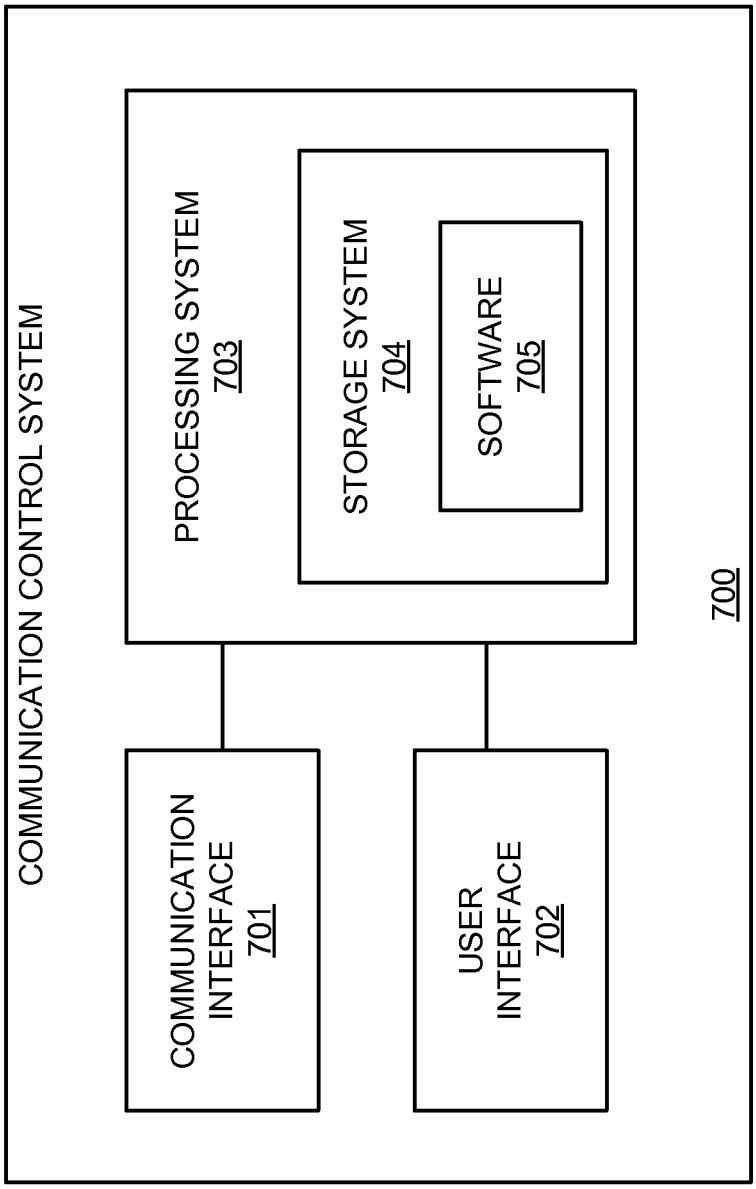

COMMUNICATION CONTROL SYSTEM
PROCESSING SYSTEM
703
STORAGE SYSTEM
704
SOFTWARE
705
COMMUNICATION
INTERFACE
701
USER
INTERFACE
702
700

FIGURE 7

MULTI-FREQUENCY REAL-TIME DATA STREAM HANDOFF

TECHNICAL BACKGROUND

Wireless communication may be used as a means of accessing a network. Wireless communication has certain advantages over wired communications for accessing a network. One of those advantages is a lower cost of infrastructure to provide access to many separate locations or addresses compared to wired communications. This is the so-called "last mile" problem. Another advantage is mobility. Wireless communication devices, such as cell phones, are not tied by wires to a fixed location. To use wireless communication to access a network, a customer needs to have at least one transceiver in active communication with another transceiver that is connected to the network.

To facilitate wireless communications, the Institute of Electrical and Electronics Engineers (IEEE) has promulgated a number of wireless standards. These include the 802.11 (WiFi) standards and the 802.16 (WiMAX) standards. Likewise, the International Telecommunication Union (ITU) has promulgated standards to facilitate wireless communications. This includes TIA-856, which is also known as Evolution-Data Optimized (EV-DO). The European Telecommunications Standards Institute (ETSI) has also promulgated a standard known as long term evolution (LTE). Additional standards such as the fourth generation communication system (4G) are also being pursued. These standards pursue the aim of providing a comprehensive IP solution where voice, data, and streamed multimedia can be given to users on an "anytime, anywhere" basis. These standards also aim to provide higher data rates than previous generations. All of these standards may include specifications for various aspects of wireless communication with a network. These aspects include processes for registering on the network, carrier modulation, frequency bands of operation, and message formats.

Overview

A method of operating a communication system is disclosed. A time sensitive data stream is sent to a wireless device via a first wireless station. A handoff criteria is determined to have been satisfied. Based on the handoff criteria being satisfied, at least one control message is sent that instructs the wireless device to increase a buffer size associated with the time sensitive data stream.

A method of operating a wireless device is disclosed. A time sensitive data stream sent by a first wireless station is received at a wireless device. It is determined that a handoff criteria has been satisfied. Based on the handoff criteria being satisfied, the wireless device increases a buffer size associated with the time sensitive data stream.

A method of operating a communication system is disclosed. A time sensitive data stream is sent to a wireless device via a first wireless station. A handoff criteria is determined to have been satisfied. A message is sent to the first wireless station indicating that the handoff criteria has been satisfied. An indicator is sent to a second wireless station. This indicator is associated with a handoff of the wireless device from the first wireless station to the second wireless station. Based on the handoff criteria being satisfied, a buffer size associated with the time sensitive data stream is increased.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram illustrating a communication system.

FIG. **2** is a flowchart illustrating a method of operating a communication system.

FIG. **3** is a flowchart illustrating a method of operating a wireless device.

FIG. **4** is a flowchart illustrating a method of operating a communication system.

FIG. **5** is a flowchart illustrating a method of controlling a communication system.

FIG. **6** is a block diagram of a wireless communication device.

FIG. **7** is a block diagram of a communication control system.

DETAILED DESCRIPTION

In an embodiment, a time sensitive or real-time data stream may be multicast to a wireless device. Examples of time sensitive data streams include audio and video data streams. These data stream may comprise real-time protocol (RTP) or real time control protocol (RTCP) packets. The device buffers part of this data stream before it is presented to the user of the wireless device. The time sensitive data stream is sent via a first wireless station when the wireless device is in the service area of that wireless station.

When the wireless device approaches an edge of the service area for the first wireless station, a handoff of the wireless device from the first wireless station to a second wireless station is determined to be likely. This likelihood may be expressed as a handoff condition. The second wireless station may not be broadcasting the multicast time sensitive data stream. The amount of the time sensitive data stream that is buffered is increased when the handoff condition is satisfied. This allows the wireless device to present the data stream without interruption during a handoff, scanning, and/or while the data stream is redirected to the second wireless station. When the handoff condition is no longer satisfied, either by handoff, or by the wireless device moving away from the edge of the service area, the buffer size may be reduced.

FIG. **1** is a block diagram illustrating a communication system. In FIG. **1**, communication system **100** comprises service area **110**, service area **120**, base station **115**, base station **125**, and wireless device **130**. Base stations **115** and **125** may also be referred to as wireless stations. Base station **115** is operatively coupled to network **120**. Base station **125** is operatively coupled to network **120**. Wireless device **130** is operatively coupled to base station **115** via wireless link **140**. Wireless device **130** may be coupled to base station **125** via wireless link **141**. Thus, wireless device **130** may receive a time sensitive (e.g., real time audio and video) data stream from network **120** via base station **115** or base station **125**.

Service area **110** comprises three sectors A**1** **111**, B**1** **112**, and C**1** **113**. Service area **120** comprises three sectors A**2** **121**, B**2** **122**, and C**2** **123**. Wireless device **130** receives a multicast time sensitive data stream from base station **115** via wireless link **140**. Wireless device **130** is shown in sector A**1** **111** of service area **110**.

In FIG. **1**, service area **110** and service area **120** are shown as hexagons. Each sector **111-113** and **121-123** of service area **110** and service area **120**, respectively, occupies one-third of a hexagon. The sectors in FIG. **1** are shown with the "A" sectors **111** and **121** in the upper right one-third of the service area **110** and **120**, respectively. The "B" sectors **112** and **122** are shown in the lower right one-third of service area **110** and **120**, respectively. The "C" sectors **113** and **123** are shown in the left one-third of service area **110** and **120**, respectively. Also in FIG. **1**, sector A**1** **111** and C**2** **123** are adjacent and share a common boundary.

Service area **110** illustrates the area serviced by base station **115**. Sectors A**1** **111**, B**1** **112**, and C**1** **113** correspond to

areas serviced by different frequencies transmitted from base station **115**. Service area **120** illustrates the area serviced by base station **125**. Sectors A**2** **121**, B**2** **122**, and C**2** **123** correspond to areas serviced by different frequencies transmitted from base station **125**.

Sub-channels are allocations of frequency and time that base station **115** and base station **125** utilize to communicate with wireless device **130** and wireless device **131**, respectively. For example, in a WiMAX specified system, transmissions are divided up into frames. Frames are allocations of transmission times. Each frame is further divided up into allocations of frequency and symbols. Symbols are an allocation of time that is less than a frame. A minimum unit of frequency and time that may be allocated in a frame of a WiMAX specified system may be referred to as a slot. In a WiMAX system, a sub-channel may be a particular allocation of one or more slots. The term "slot" may be applied to other wireless systems. In particular the term "slot" (meaning a unit allocation of frequency and time) may be used to describe the sub-channels of other systems that utilize orthogonal frequency-division multiple access (OFDMA).

Wireless device **130** may be any device, system, combination of devices, or other such communication platform capable of communicating a time sensitive data stream with base station **115** and base station **125** via wireless links **140** and **141**, respectively. Wireless device **130** may be, or comprise, for example, a mobile phone, a wireless phone, a wireless modem, a personal digital assistant (PDA), a voice over internet protocol (VoIP) phone, a voice over packet (VOP) phone, or a soft phone, as well as other types of devices or systems that can exchange data with base station **115** and base station **125** via wireless links **140** and **141**. Other types of communication platforms are possible.

Base station **115** and base station **125** may be any wireless system that provides the air interface to wireless device **130**. Examples of base stations that may be utilized include, base transceiver stations (BTSs), radio base stations (RBSs), Node B, enhanced Node B (eNBs) and others. Base stations may include a number of elements known to those skilled in the art comprising a transceiver, power amplifier, combiner, duplexer, antenna and control function.

Wireless links **140**-**141** uses the air, or space, as the transport media. Wireless links **131**-**134** may use various protocols, such as Code Division Multiple Access (CDMA), Evolution Data Only (EVDO), Worldwide Interoperability for Microwave Access (WIMAX), Global System for Mobile Communication (GSM), Long Term Evolution (LTE), Wireless Fidelity (WIFI), High Speed Packet Access (HSPA), or some other wireless communication format.

Network **120** may be any network or collection of networks that couple, link, or otherwise operatively connect base stations **115** and **125** with other devices or systems. Network **120** may include other secondary data networks. In an example, network **120** may include a backhaul network, a local network, a long distance network, a packet network, the internet, or any combination thereof, as well as other types of networks. Network **120** may comprise communication links that use metal, glass, air, space, or some other material as the transport media. These communication links could use various communication protocols, such as Time Division Multiplex (TDM), Internet Protocol (IP), Ethernet, communication signaling, CDMA, EVDO, WIMAX, GSM, LTE, WIFI, HSPA, or some other communication format—including combinations thereof. The communication links of network **150** could be direct links, or may include intermediate networks, systems, or devices.

In an example, network **120** may be, or include all or parts of an IEEE 802.16 (WiMAX) specified system. These parts may include additional base stations (BSs), an access services network (ASN), access services network gateway (ASN-GW), or connectivity service network (CSN).

In communication system **100**, all "A" sectors may transmit on different frequencies than the "B" and "C" sectors (e.g., B**1** **111**, B**2** **122**, C**1** **113** and C**2** **123**). All "B" sectors may transmit on different frequencies than the "A" and "C" sectors, and so on. Since an "A" sector is adjacent to a "B" sector and a "C" sector, choosing the frequencies to be different between any "A" sector and any "B" or "C" sector, results in reduced interference between adjacent sectors. However, this also means that when wireless device **130** is handed off between base stations **115** and **125**, it must change frequencies to communicate with the adjacent base station.

In an embodiment, when wireless device **130** is receiving a time sensitive data stream and moves near the boundary of sector A**1** **111** and C**2** **123**, a handoff criteria may be satisfied. For example, the signal to interference and noise ratio (SINR) or carrier to interference and noise ratio (CINR) received by wireless device **130** may fall below a specified threshold. In another example, the CINR or SINR associated with base station **115** by wireless device **130** may fall below the CINR or SINR, respectively, associated with base station **125**. In another example, wireless device **130** may send an indicator of CINR, SINR, or other factors such as packet loss and/or packet error rate, to base station **115** or base station **125**. These factors, or other factors associated with wireless device **130** may be used to determine an indicator associated with the likelihood of a handoff to base station **115** or base station **125**.

In an embodiment, the handoff criteria may be based on an indicator of the likelihood of a handoff. Thus, satisfying the handoff criteria may not actually cause a handoff. Satisfying other criteria, or other thresholds, may be required to cause a handoff of wireless device **130** from base station **115** to base station **125**. In addition, other indicators of the likelihood of a handoff, such as those based on the location of wireless device **130**, may be used.

When the handoff criteria is satisfied, it indicates to communication system **100** that there is an increased likelihood of a handoff of wireless device **130** from base station **115** to base station **125**. Based on the handoff criteria being satisfied, a control message may be sent that instructs wireless device **130** to increase the size of the buffer associated with the time sensitive data stream. Increasing the size of the buffer associated with the time sensitive data stream allows wireless device **130** to store more of the time sensitive data stream before it is presented to the user.

By storing additional time sensitive data in the buffer, wireless device **130** may continue to present data to the user during interruptions to the reception of the time sensitive data stream caused by activities associated with a handoff of wireless device **130** from base station **115** to wireless device **125**. For example, wireless device **130** may stop receiving the time sensitive data stream from base station **115** in order to scan for base station **125**. In another example, base station **115** and base station **125** may not be synchronized in the sending of the time sensitive data stream. In this case, as the handoff of wireless device **130** occurs, it may appear to wireless device **130** that the time sensitive data stream has "jumped ahead" or is repeating itself. Because the data being presented to the user is coming from the larger sized buffer, it helps wireless device **130** to continue to present the time sensitive data stream without disruption even when the data stream skips forward or backward.

After wireless device **130** has been handed off, or after the handoff criteria is no longer satisfied, a control message may be sent that instructs wireless device **130** to decrease the size of the buffer associated with the time sensitive data stream. Decreasing the buffer size associated with the time sensitive data stream conserves resources, such as memory space, within wireless device **130**.

In an embodiment, wireless device **130** receives the time sensitive data stream sent by base station **115**. Wireless device **130** may determine that a handoff criteria has been satisfied. Wireless device **130** may determine the handoff criteria has been satisfied as a result of wireless device **130** moving near the boundary of sector A1 **111** and C2 **123**. For example, when wireless device **130** is near the boundary of a sector (e.g., A1 **111**) the SINR or CINR received by wireless device **130** from base station **115** may fall below a specified threshold. In another example, the CINR or SINR associated with base station **115** by wireless device **130** may approach within a threshold amount of the CINR or SINR, respectively, associated with base station **125**. Based on a variety of other factors, such as packet loss or packet error rate, wireless device **130** may determine that a handoff criteria has been satisfied. Wireless device **130** may determine an indicator associated with the likelihood of a handoff to base station **115** or base station **125**. This indicator associated with the likelihood of a handoff may be used to help determine whether the handoff criteria has been satisfied.

When the handoff criteria is satisfied, it indicates to wireless device **130** that there is an increased likelihood of a handoff of wireless device **130** from base station **115** to base station **125**. Based on the handoff criteria being satisfied, wireless device **130** may determine to increase the size of the buffer associated with the time sensitive data stream. Increasing the size of the buffer associated with the time sensitive data stream allows wireless device **130** to store more of the time sensitive data stream before it is presented to the user.

As part of being handed off from base station **115** to base station **125**, wireless device **130** may end its communication session with base station **115**. Wireless device **130** may establish a new communication session with base station **125**. After wireless device **130** has been handed off, or after the handoff criteria is no longer satisfied, wireless device **130** may determine to decrease the size of the buffer associated with the time sensitive data stream. Decreasing the buffer size associated with the time sensitive data stream conserves the resources, such as memory space, of wireless device **130**.

FIG. **2** is a flowchart illustrating a method of operating a communication system. The steps illustrated in FIG. **2** may be performed by one or more elements of communication system **100**.

A time sensitive data stream is sent to a wireless device via a first wireless station (**202**). For example, a data stream associated with real-time audio and/or video may be sent to wireless device **130** via base station **115**. This data stream may comprise RTP or RTCP packets.

A handoff criteria is determined to be satisfied (**204**). For example, base station **115** may determine that it is likely that wireless device **130** will be handed off to base station **125**. Base station **115** may make this determination either alone or in concert with one or more of base station **115** and network **120**. This determination may be based on CINR, SINR, or other factors and indicators such as packet loss and/or packet error rate, known or received by base station **115** or base station **125**. In an example, the handoff criteria that is satisfied may be based on a calculated likelihood of a handoff. In another example, the handoff criteria that is satisfied may be based directly on CINR, SINR, or other factors and indicators such as packet loss and/or packet error rate, known or received by base station **115** or base station **125**.

Based on the handoff criteria being satisfied, at least one control message is sent that instruct the wireless device to increase a buffer size associated with the time sensitive data stream (**206**). For example, based on a criteria associated with the likelihood of wireless device **130** being handed off from base station **115** to base station **125**, base station **115** may send a message instructing wireless device **130** to increase the size of a buffer associated with a real-time data stream. In addition, based on the handoff criteria being satisfied, a message may be sent to base station **125** instructing it to start broadcasting the time sensitive data stream. In an embodiment, base station **125** may be instructed to start broadcasting (or multicasting) the time sensitive data stream only if it was not already broadcasting the time sensitive data stream.

FIG. **3** is a flowchart illustrating a method of operating a wireless device. The steps illustrated in FIG. **3** may be performed by one or more elements of communication system **100**.

A time sensitive data stream sent by a first wireless station is received at a wireless device (**302**). For example, wireless device **130** may receive a real-time data stream from base station **115**. This data stream may be associated with real-time audio and/or video and may be sent to wireless device **130** via base station **115**. This data stream may comprise RTP or RTCP packets.

A handoff criteria is determined to have been satisfied (**304**). For example, wireless device **130** may determine that it is likely it will be handed off to base station **125**. Wireless device **130** may make this determination either alone or in concert with one or more of base station **115**, base station **125**, and network **120**. This determination may be based on CINR, SINR, or other factors and indicators such as packet loss and/or packet error rate, known or received by wireless device **130**. In an example, the handoff criteria that is satisfied may be based on a calculated likelihood of a handoff. In another example, the handoff criteria that is satisfied by be based directly on CINR, SINR, or other factors and indicators such as packet loss and/or packet error rate, known or received by wireless device **130**.

Based on the handoff criteria being satisfied, a buffer size associated with the time sensitive data stream is increased (**306**). For example, based on wireless device **130** determining it is likely to be handed off from base station **115** to base station **125**, wireless device **130** may increase the size of an internal buffer associated with a real-time data stream. In addition, based on the handoff criteria being satisfied, wireless device **130**, network **120**, or base station **115** may send a message to base station **125** instructing it to start broadcasting the time sensitive data stream. In an embodiment, base station **125** may be instructed to start broadcasting (or multicasting) the time sensitive data stream only if it was not already broadcasting the time sensitive data stream.

FIG. **4** is a flowchart illustrating a method of operating a communication system. The steps illustrated in FIG. **4** may be performed by one or more elements of communication system **100**.

A time sensitive data stream is sent to a wireless device via a first wireless station (**402**). For example, a data stream associated with real-time audio and/or video may be sent to wireless device **130** via base station **115**. This data stream may comprise RTP or RTCP packets.

A handoff criteria is determined to have been satisfied (**404**). For example, wireless device **130** may determine that it is likely it will be handed off to base station **125**. Wireless device **130** may make this determination either alone or in

concert with one or more of base station **115**, base station **125**, and network **120**. This determination may be based on CINR, SINR, or other factors and indicators such as packet loss and/or packet error rate, known or received by wireless device **130**. In an example, the handoff criteria that is satisfied may be based on a calculated likelihood of a handoff. In another example, the handoff criteria that is satisfied by be based directly on CINR, SINR, or other factors and indicators such as packet loss and/or packet error rate, known or received by wireless device **130**.

An indicator that a handoff criteria has been satisfied is sent to the first wireless station (**406**). For example, wireless device **130** may send an indicator to base station **115**. This indicator may be associated with wireless device **130**'s determination that the handoff criteria has been satisfied. This indicator may be associated with one or more of CINR, SINR, and other factors or indicators such as packet loss and/or packet error rate, known or received by wireless device **130**. In an embodiment, base station **115** may use this indicator along with other criteria to determine an indicator of the likelihood that wireless device **130** will be handed off.

An indicator associated with a handoff of the wireless device is sent to a second wireless station (**408**). For example, base station **115** may send a message to base station **125**. This message may initiate a handoff process. This message may be associated with the likelihood that wireless device **130** will be handed off from base station **115** to base station **125**.

Based on the handoff criteria being satisfied, a buffer size associated with the time sensitive data stream is increased (**410**). For example, based on wireless device **130** determining it is likely to be handed off from base station **115** to base station **125**, wireless device **130** may increase the size of an internal buffer associated with a real-time data stream. In addition, based on the handoff criteria being satisfied, wireless device **130**, network **120**, or base station **115** may send a message to base station **125** instructing base station **125** to start broadcasting the time sensitive data stream. In an embodiment, base station **125** may be instructed to start broadcasting (or multi-casting) the time sensitive data stream only if it was not already broadcasting the time sensitive data stream. As a result of receiving this message, base station **125** may allocate, or increase the size of, a buffer associated with the time sensitive data stream.

FIG. **5** is a flowchart illustrating a method of controlling a communication system. The steps illustrated in FIG. **5** may be performed by one or more elements of communication system **100**.

A time sensitive data stream is communicated with a wireless device via a first wireless station (**502**). For example, a data stream associated with real-time audio and/or video may be communicated to wireless device **130** via base station **115** using a multicasting protocol. This data stream may comprise RTP or RTCP packets.

A handoff criteria is determined to have been satisfied (**504**). For example, wireless device **130** may determine that a threshold condition associated with the likelihood it will be handed off to base station **125** has been satisfied. Wireless device **130** may make this determination either alone or in concert with one or more of base station **115**, base station **125**, and network **120**. This determination may be based on CINR, SINR, or other factors and indicators such as packet loss and/or packet error rate, known or received by wireless device **130**. In an example, the handoff criteria that is satisfied may be based on a calculated likelihood of a handoff. In another example, the handoff criteria that is satisfied may be based directly on CINR, SINR, or other factors and indicators such as packet loss and/or packet error rate, known or received by wireless device **130**.

Based on the handoff criteria being satisfied, a buffer size associated with the time sensitive data stream is increased (**506**). For example, based on wireless device **130** determining it is likely to be handed off from base station **115** to base station **125**, wireless device **130** may increase the size of an internal buffer associated with a real-time data stream. In an embodiment, base station **115** or base station **125** may allocate, or increase the size of, a buffer associated with the time sensitive data stream based on a handoff criteria being satisfied.

The time sensitive data stream is broadcast via a second wireless station (**508**). For example, wireless device **130**, network **120**, or base station **115** may send a message to base station **125** instructing base station **125** to start broadcasting the time sensitive data stream. In an embodiment, base station **125** may be instructed to start broadcasting (or multicasting) the time sensitive data stream if it was not already broadcasting the time sensitive data stream.

A time sensitive data stream is communicated with the wireless device via the first wireless station (**510**). In FIG. **5**, this block is shown with a dashed line because it is an optional step. For example, block **510** would not be performed if wireless device **130** is handed off from base station **115** to base station **125**. However, block **510** would be performed if wireless device **130** is not handed off from base station **115** to base station **125**.

Based on the handoff criteria no longer being satisfied, a buffer size associated with the time sensitive data stream is decreased (**512**). For example, wireless device **130** may move away from the edge of the service area associated with base station **115**. This may cause the handoff criteria to no longer be satisfied. In other words, one or more of CINR, SINR, or other factors and indicators such as packet loss and/or packet error rate, known or received by wireless device **130** may improve to an extent such that the handoff criteria is no longer satisfied. As a result of the handoff criteria no longer being satisfied, wireless device **130** may decrease a buffer size associated with the time sensitive data stream. In another embodiment, wireless device **130** may be instructed to decrease a buffer size associated with the time sensitive data stream as a result of the handoff criteria no longer being satisfied.

FIG. **6** illustrates wireless communication device **600**. Wireless communication device **600** is an example of wireless device **130**, although wireless device **130** could use alternative configurations. Wireless communication device **600** comprises wireless communication interface **601**, user interface **602**, and processing system **603**. Processing system **603** is linked to wireless communication interface **601** and user interface **602**. Processing system **603** includes processing circuitry and storage system **604** that stores software **604**. Wireless communication device **601** may include other well-known components such as a battery and enclosure that are not shown for clarity. Wireless communication device **600** may be a telephone, computer, e-book, mobile Internet appliance, media player, game console, wireless network interface card, or some other wireless communication apparatus—including combinations thereof.

Wireless communication interface **601** comprises RF communication circuitry and an antenna. The RF communication circuitry typically includes an amplifier, filter, RF modulator, and signal processing circuitry. Wireless communication interface **601** may also include a memory device, software, processing circuitry, or some other communication device.

Wireless communication interface **601** may use various protocols, such as CDMA, EVDO, WIMAX, GSM, LTE, WIFI, HSPA, or some other wireless communication format.

User interface **602** comprises components that interact with a user to receive user inputs and to present media and/or information. User interface **602** may include a speaker, microphone, buttons, lights, display screen, touch screen, touch pad, scroll wheel, communication port, or some other user input/output apparatus—including combinations thereof. User interface **602** may be omitted in some examples.

Processing system **603** may comprise a microprocessor and other circuitry that retrieves and executes software **605** from storage system **604**. Storage system **604** may comprise a disk drive, flash drive, data storage circuitry, or some other memory apparatus. Processing system **603** is typically mounted on a circuit board that may also hold storage system **604** and portions of wireless communication interface **601** and user interface **602**. Software **605** comprises computer programs, firmware, or some other form of machine-readable processing instructions. Software **605** may include an operating system, utilities, drivers, network interfaces, applications, or some other type of software. When executed by processing system **603**, software **605** directs processing system **603** to operate wireless communication device **600** as described herein.

FIG. **7** illustrates communication control system **700**. Communication control system **700** may be an example of one or more components of communication system **100**. This includes, but is not limited to base station **115**, base station **125**, and network **120**, although these and other systems may use alternative configurations. Communication control system **700** comprises communication interface **701**, user interface **702**, and processing system **703**. Processing system **703** is linked to communication interface **701** and user interface **702**. Processing system **703** includes storage system **704** that stores software **705**.

Communication interface **701** comprises components that communicate over communication links, such as network cards, ports, RF transceivers, processing circuitry and software, or some other communication devices. Communication interface **701** may be configured to communicate over metallic, wireless, or optical links. Communication interface **701** may be configured to use TDM, IP, Ethernet, optical networking, wireless protocols, communication signaling, or some other communication format—including combinations thereof.

User interface **702** comprises components that interact with a user. User interface **702** may include a keyboard, display screen, mouse, touch pad, or some other user input/output apparatus. User interface **702** may be omitted in some examples.

Processing system **703** may comprise a microprocessor and other circuitry that retrieves and executes software **705** from storage system **704**. Storage system **704** may comprise a disk drive, flash drive, data storage circuitry, or some other memory apparatus. Software **705** comprises computer programs, firmware, or some other form of machine-readable processing instructions. Software **705** may include an operating system, utilities, drivers, network interfaces, applications, or some other type of software. When executed by processing system **703**, software **705** directs processing system **703** to operate communication control system **700** as described herein.

The above description and associated figures teach the best mode of the invention. The following claims specify the scope of the invention. Note that some aspects of the best mode may not fall within the scope of the invention as specified by the claims. Those skilled in the art will appreciate that the features described above can be combined in various ways to form multiple variations of the invention. As a result, the invention is not limited to the specific embodiments described above, but only by the following claims and their equivalents.

What is claimed is:

1. A method of operating a communication system, comprising:

transmitting, via a first wireless station using a first frequency, a time sensitive multicast data stream to a wireless device that is changing position relative to a sector boundary; and

instructing the wireless device to increase an internal buffer size associated with the time sensitive multicast data stream when a handoff criteria is satisfied;

interrupting a receipt of the time sensitive multicast data stream transmitted via the first wireless station at the wireless device and instructing the wireless device to scan for a second wireless station using a second frequency, wherein the second frequency is different from the first frequency;

instructing the second wireless station to allocate a buffer associated with the time sensitive multicast data stream and broadcast the time sensitive multicast data stream using the second frequency; and,

transmitting, via the second wireless station, the time sensitive multicast data stream to the wireless device and instructing the wireless device to decrease the internal buffer size associated with the time sensitive multicast data stream.

2. The method of claim **1**, wherein the handoff criteria is based on at least one of an indicator of a likelihood of a handoff and an indicator of received signal strength.

3. The method of claim **1**, further comprising:

handing off the wireless device to the second wireless station.

4. The method of claim **3**, further comprising:

based on the handoff of the wireless device from the first wireless station to the second wireless station, sending at least one control message that instructs the second wireless station to decrease the buffer size associated with the time sensitive multicast data stream.

5. The method of claim **1**, wherein the time sensitive multicast data stream is associated with a video data stream.

6. The method of claim **5**, further comprising:

based on the handoff criteria no longer being satisfied, sending at least one control message that instructs the wireless device to decrease the internal buffer size associated with the time sensitive multicast data stream.

7. A system for operating a wireless device, comprising:

a controller configured to:

transmit, via a first wireless station using a first frequency, receiving, at a wireless device, a time sensitive multicast data stream to a wireless device that is changing position relative to a sector boundary;

increase an internal buffer size associated with the time sensitive multicast data stream at the wireless device when a handoff criteria is satisfied;

interrupt a receipt of the time sensitive multicast data stream transmitted via the first wireless station at the wireless device;

instruct the wireless device to scan for a second wireless station using a second frequency, wherein the second frequency is different from the first frequency;

instruct the second wireless station to allocate a buffer associated with the time sensitive multicast data

stream and broadcast the time sensitive multicast data stream using the second frequency; and,

transmit, via the second wireless station, the time sensitive multicast data stream to the wireless device.

8. The system of claim **7**, wherein the handoff criteria is based on an indicator of a likelihood of a handoff and an indicator of received signal strength.

9. The system of claim **7**, wherein the controller is further configured to:

end a communication session with the first wireless station; and

establish a second communication session with the second wireless station.

10. The system of claim **9**, wherein the controller is further configured to:

based on establishment of the second communication session with the second wireless station, decrease, by the wireless device, the internal buffer size associated with the time sensitive multicast data stream.

11. The system of claim **7**, wherein the time sensitive multicast data stream is associated with a video data stream.

12. The system of claim **11**, wherein the controller is further configured to:

based on the handoff criteria no longer being satisfied, decrease, by the wireless device, the internal buffer size associated with the time sensitive multicast data stream.

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